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FOOD VALUES

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Food Values

In the narrower sense of the term *food value* refers to heat—or energy-equivalent of proteins, carbohydrates or fats or mixtures of these in food materials. In the following pages a much broader meaning is given to this term. The amount of heat, measured in calories, that may be obtained by burning a food is only a part of the story of foods. It is an erroneous but still quite prevalent practice to discuss and compare foods on a basis of chemical composition from which calories are calculated. While the composition of a food is perhaps its most important feature, there are many other properties that must be carefully considered before we can estimate the true and complete value of a food.

To some people the value of a food is closely related to its flavor only; food is good and valuable if it tastes good. Others judge food on a dollar and cents basis; to them expensive food is synonymous with good food. Still others do not connect "value" in any sense of the word with foods; sometimes they eat and think, but most of the time they simply eat.

The word *values* is used in the plural, so that in the following discussion there may be included the different factors which make a food valuable and desirable.

Flavor

Without the proper flavor a food would be little better than a medicine. Flavor makes food appetizing, and palatability is one of its first requisites. The difference in price as well as digestibility is often due to flavor. Choice cuts of meats, certain kinds of fish or fowl, wines, cheese, all contain some substance or substances which are the "key to the whole food problem"—so-called by H. T. Finck in his interesting and readable book on "Food and Flavor." Common observation as well as research experiments prove that, everything else being equal, a food which has a desirable flavor is more readily digested than one which is not palatable.

Closely related to the flavor of a food is its odor. In fact, many people believe that what is usually considered to be the flavor tasted is in realty the odor smelled. Much attention is being given to cultivation, production, and preparation of foods so as to produce the most desirable flavors. The flavor of meats is improved by proper feeding of the

animals; cheese is ripened by the addition of bacteria producing certain flavors; unfertilized hens' eggs have a flavor superior to those fertilized.

The appearance of an appetizing food adds greatly to its value. It stimulates the secretion of digestive fluids. One is inclined to believe that foods are often prepared to be photographed rather than eaten, and flavor as well as other values seem to be sacrificed for appearance.

Appearance

The value of a food depends in a large measure upon its natural appearance, or its appearance after it leaves the kitchen. Proper cooking, of course, does more than change the appearance of a food—it creates a food value, because it changes the composition, flavor and digestibility. Cooking also destroys germs and other organisms frequently present in uncooked foods. The appearance of a food, such as oleomargarine, may also be improved by coloring; by bleaching, as is done with flour; dyeing, as in the case of candies, mustard, maraschino cherries, and sometimes peas and ketchup and many others. These "improvements" in appearance often seriously affect the other properties and are really adulterations.

Certainly an important factor in making a food valuable is its digestibility. This term is given two meanings: first, the *ease* or *readiness* with which a food is digested, i. e., time required: second, the *percentage* of digestibility. Some foods are quickly and more or less easily digested, while others leave an indigestible residue. The value of a food to any individual therefore depends upon its digestibility and the condition of the individual's digestive tract. Some people can digest very few foods, while others, especially growing children, have digestions that rival those attributed to goats and ostriches.

Digestibility

Much that is said and written about the medicinal value of foods, especially of vegetables, is sheer nonsense, and most of the remainder is tradition. Chemists have not been able to isolate medicinal substances from vegetables or other foods. For that matter it would probably involve us in difficulties if we attempted to differentiate between medicines and foods that have a therapeutic value.

Medicinal Value

To read about a medicine-food combination, a sort of two-in-one, is interesting if one is not particular about facts. Tradition has it that celery is loaded with medicine that will heal diseased nerves, and fish is good for brains; spinach is good for the blood, because it contains iron

and iron makes blood; lettuce is supposed to make one sleep. Some people eat watercress to remove pimples; carrots to prevent dyspepsia; dandelions for the liver; cucumbers to cool the blood and onions for everything not included in the above. So far as we know, vegetables do not possess specific medicinal properties. However, certain foods, especially vegetables, are an important and necessary part of a well balanced diet. They contain vitamins and other growth essentials; they are usually rich in desirable mineral matter. They contain considerable water in a highly purified form which is valuable for digestive processes; and finally, they contain indigestible matter, such as cellulose or woody materials, called "crude fiber" or "roughage," which stimulates peristalsis and regulates bowel action.

Purity

That foods should be pure is almost axiomatic. Any suspicion or knowledge that our food is not pure immediately suggests adulteration. A food might be called adulterated when it is sold or eaten for something other than as it is labeled, but many foods are properly labeled and yet are most dangerously adulterated, or rather *contaminated.* Anyone who has ever given a thought to the subject of food adulteration in general, and contamination through unsanitary handling in particular, must be convinced that there is still much need for improvement in food sanitation. A few examples will be sufficient. Think of the possibilities of unwrapped bread becoming contaminated; there must be hundreds of persons engaged in handling foods who have infectious diseases; there are still many quick-lunch places where money and food are actually handled by the same person.

Food Poisoning

Save only the medicinal value of foods, this topic, more than any other, tempts amateur food experts to rush into print. Many absurd statements are made about ptomain poisoning. When no other explanation is at hand, almost any kind of digestive disturbance is blamed on ptomains. In the popular mind, food in tin cans is almost always under suspicion; but tin and ptomain have only the alliteration in common. Under *food poisoning* there should be included bacterial contamination, chemical decomposition, accidental addition of metallic or other poisons, deliberate use of poisonous preservatives, eating of substances supposed to be, or mistaken for, foods—such as toadstools.

We go to specialists for information on every other subject except the one that most vitally concerns us—foods. Apparently everybody

who is willing to write or talk about foods becomes a specialist; many people believe anything they hear or read about foods and presently become food experts themselves. Almost without exception what is said about foods in advertisements of food experts, food specialists, patent medicines and the like, is worse than useless and should be prohibited by law. Occasionally —but unfortunately not often enough—a food faker is barred from the use of the United States mails. In pleasing contrast are the researches and writings of the real experts in food science. Their number is too large for enumeration here, but mention should be made of a most important series of articles on "What We Eat and What Happens to It" by Professor Philip B. Hawk in the *Ladies' Home Journal.* Much of what Professor Hawk writes is based upon recent researches and experiments by himself and co-workers. The following also are excellent: Dr. H. W. Wiley: "Foods and Their Adulteration," "Our Daily Bread," articles in *Good Housekeeping*; Dr. Woods Hutchinson: "We and our Children," numerous other books and magazine articles; Alexander Bryce, "Modern Theories of Diet;" Fisher and Fiske, "How to Live;" E. Purinton, "Efficient Living;" Dr. Percy Stiles, "An Adequate Diet;" Dr. Lafayette B. Mendel, "Changes in the Food Supply and their Relation to Nutrition;" Bulletins: Cornell Reading Course for Farm Home, Ithaca, N. Y.; United States Government Bulletins, Dept. of Agriculture, Washington, D. C.

Misinformation

The most important progress in food science during recent years is due to the discovery of certain substances, as yet unidentified, and which are necessary for the maintenance of growth. The name *growth essentials* seems most appropriate. Other terms used are growth determinants, food accessories, accessory factors, growth regulators. They occur in many foods, not in all, and a number of classes of growth essentials are known.

Growth Essentials

Vitamins are unidentified substances present usually in very small amounts, found principally in fresh fruits and vegetables, grains, eggs, milk, meats and brewers' yeast and yeast extracts. The continued use of a diet practically free from vitamins is believed to be the cause of such disorders as beri-beri, scurvy, etc., called nutritional disorders or deficiency diseases. Vitamins are water soluble, and are more or less destroyed when heated. This means that vitamins are often lost during the process of cooking, and that foods

Vitamins

must be eaten raw in order to get the greatest benefit of the vitamins. Of course, certain foods cannot be eaten raw on account of the indigestibility of some of their components. Vitamins are removed from certain foods by special treatment, such as the polishing of rice, which removes practically all of the vitamins.

"Fat Soluble A"—This is the name given to growth essentials found associated with fats or the fatty part of a food. In their physiological effect they resemble vitamins, but as the name indicates they are not soluble in water, only soluble in fats.

Mineral Matter—This could properly be classed as a growth essential. Experiments have shown that a diet free from mineral matter soon causes serious nutritional disturbances.

Amino Acids—Proteins are complex chemical compounds consisting mainly of chemically united amino acids; most protein molecules contain probably eighteen or more of these acids. The proteins of the human body are formed from the amino acids obtained by the digestion of food proteins. *But a food protein in order to be suitable for building body proteins, must contain certain amino acids.* If these are not present in the food, then the proteins of the latter are not "complete" and are inadequate for building up body proteins.

Prices

The commercial value of foods is intimately related to diets and nutrition. Frequently a change or a fad in diets causes a change in price. But much more frequently the reverse is true; a change in prices produces radical changes in diets. When potatoes were one dollar and twenty cents a peck, people ate less of them, and the steady rise in meat prices is gradually lessening meat consumption. The present price of flour and bread is turning people's attention toward corn products. It will not be necessary to discuss the reasons for high prices; nearly everybody has a theory about them. The writer believes that high prices in this country are due principally to the increasing amount of gold and use of credits. Of course, just now the war is an important factor; but prices were steadily rising even before the war.*

Chemical Composition and Fuel Value

To many people the value of a food depends upon its chemical composition. A food with a high percentage of fats, carbohydrates or

* See Irving Fisher, *Elementary Principles of Economics*, N. Y., 1913.

proteins, or all of these, is a rich or valuable food. But it is evident from what has been said that more than composition must be considered. The composition of food is, however, important and a diet in order to be adequate should supply from three thousand to thirty-five hundred calories a day to a man doing ordinary work. One of the simplest and at the same time safest rules is *to provide a mixed diet which will give from* 3,000 to 3,500 *calories daily* ; the proteins, vitamins and food essentials will take care of themselves if proper emphasis has been put on mixed diet.

Explanation of terms used

Calorie—This term is used as the unit of heat measurement. It is the name given to that amount of heat which will raise the temperature of one kilogram (1000 grams) of water one degree centigrade. A calorie will raise the temperature of nearly four pounds (3.968) of water one degree Fahrenheit.

When a combustible substance is burned a certain definite amount of heat or energy is liberated. As the chemist and the physicist say, the reaction is *exothermic.* The heat liberated is called *heat of combustion* and its amount, measured in calories, is called the *calorific value* of the substance.

Fuel Value—Calorific Value—These terms are used with reference to the amount of heat produced when a substance is burned.

Food Value—In a chemical sense food is burned in the body, and the effect or energy produced is often called food value. The fuel value of a food is the theoretical amount of heat that may be produced. But since foods are not completely burned in the body, the heat or energy liberated is less than called for by theory. The correct expression for the energy produced in the body is the *physiological fuel value.*

Rich or concentrated food—One that has a high fuel value.

Amino acid—An organic acid which contains one or more NH_2 groups; it contains nitrogen combined with hydrogen. Most of the other organic acids do not contain nitrogen.

A complete protein is one which has in its chemical make-up the amino acid or acids necessary for the formation of new protein.

Complete food—One which contains at least appreciable amounts of proteins, carbohydrates, fats, minerals and growth essentials. Such a food is always physiologically complete, if a sufficient number of calories are provided.

Relish—Something eaten for its flavor, without reference to food value. Relishes seldom have an appreciable food value and are eaten alone or mixed with other foods.

Explanation of the Charts

The best method of showing the composition of foods and of dietary values is by means of colored charts. By far the most elaborate and accurate charts of the kind are those prepared by Professor C. F. Langworthy of the United States Department of Agriculture, and published by the Department. The percentages of composition used are based largely upon data given in Bulletin 28 of the Department of Agriculture, "The Composition of American Food Materials," compiled by Atwater and Woods.

By permission of the Department of Agriculture, the Langworthy charts have been used as a basis for the following reproductions. Besides the reduction in size, the following changes should be noted: In the originals water is represented by a green color, while in the following charts the part intended to show the proportion of water has been left uncolored. The ash is shown by fine dots (stipple) instead of a dark gray in the originals. Representative examples of different classes of foods are shown, first as to composition and second as to food values. The composition is indicated by percentage figures of proteins, carbohydrates, fat, water and ash or mineral matter. These percentages are given to the first decimal place only, and represent averages of a great many analyses of the edible portions of American food material. In these charts the composition is visualized by using different colors for different components. The amounts of colors are approximately in the proportion indicated by the percentages. The color key appears at the top of each chart.

Proteins

Proteins are shown in red. The percentages shown are obtained by determining the percentage of nitrogen by chemical analysis and multiplying this by 6.25, giving the percentage of protein.

Fats are shown in yellow. The term "fat" in food analysis usually refers to the substances that can be extracted by means of ether and are

sometimes called "crude fat." Natural fats are always mixtures of a number of compounds, each of which is chemically classed as a fat. Chemically, a fat is nearly always a compound formed by the union of glycerine and a fatty acid. Foods, therefore, contain not only different *amounts* but also different *kinds* of fats.

Fats

Carbohydrates are shown by a blue color. In the edible portions of foods, carbohydrates consist principally of starches and sugars; but in analytical data the term "carbohydrates" includes also cellulose, gums, and woody fiber. The cellulose and woody fiber are usually present only in small amounts and are not digestible; they are also known by the term "crude fiber." Some analysists define carbohydrates as "nitrogen-free extract plus crude fiber."

Carbohydrates

Ash, also called mineral matter, is shown in the finely dotted part and consists mainly of salts (chlorides, phosphates, sulphates) of potassium, sodium, calcium, magnesium and a few other elements. Analytically, the amount of ash is determined by burning away the combustible part of a food and weighing the incombustible residue.

Ash

The portion of the pictures intended to represent the water in the foods is left uncolored. In the analysis of food, water is determined by heating in a drying oven at a temperature somewhat above 100 degrees C. to constant weight. The loss is calculated as water.

Water

In addition to the chemical composition, the charts show the *food value* of each food by a black rectangle and a statement in figures. The black square in the key represents one thousand large calories. The black rectangle under each food gives an approximate idea of the number of calories per pound. In the charts the term "fuel value" is used. This is the term usually used to express food value, although the two are not synonymous. A food is looked upon as a fuel,—a body fuel,—and if a food is nearly all digested, the term "fuel value" is sufficiently accurate.

Food Value

It should be noted that the components of a food are mentioned under five headings: proteins, fats, carbohydrates, ash, and water. It must not be inferred that foods contain nothing else. Many foods contain small amounts of substances that are chemically and physiologically

different from any of the above mentioned five classes. Included under the term "proteins" in meat there are certain water soluble substances simpler in composition than proteins and known as *extractives*. Associated with some fats there are non-fatty substances without which the fats are physiologically or nutritionally incomplete. Without these growth is incomplete. They are sometimes called "growth determinants." In this bulletin the term "growth essentials" is used.

A most important factor in a physiologically satisfactory food is its flavor and odor. However, the substances producing these qualities are present in very minute quantities and do not appear in the percentages.

Vitamins, also present in many foods, and without which a diet would be incomplete, are not shown in food charts or tables of composition. Their chemical nature is as yet only partially known, and methods for their quantitative determination have not been discovered; it is fairly certain, however, that the percentage is quite small.

Vitamins

Milk and Milk Products

Whole Milk—The most noticeable feature of milk is its large amount of water and its low fuel value. Alone it would not be sufficient to sustain a man at work; it would require too great a bulk to supply the necessary energy or calories. Milk is often called a complete or perfect food. This is true with reference to the young since it contains all the food components necessary for maintaining growth and supplying energy.

Milk protein is complete in that it contains the amino acids necessary for tissue formation, and that it is easily digested.

Milk fat contains what has been designated as "fat soluble A," an unidentified substance or substances, insoluble in water but soluble in fat—and essential for growth. This "fat soluble A" is also found in some other foods.

The principal carbohydrate in milk is *lactose*, a disaccharid which on hydrolysis, the first step in digestion, breaks down into two monosaccharids, i. e., *dextrose* and *galactose*. The *galactose* is an important factor in the development of brain and nerve tissue, and no other sugar can be effectively substituted for it.

The ash, or mineral matter, of milk contains the inorganic food essentials particularly well suited for the development of body tissues.

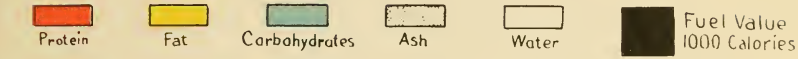
Vitamins, like the unindentified "fat soluble A" substance mentioned under milk fat, are also *growth essentials*. Milk is an important source of vitamins.

Skim milk differs from whole milk in its lower percentage of fat, and a correspondingly higher percentage of all the other components, and a lower fuel value. Its proteins, carbohydrates, mineral matter and vitamins make it valuable as a food, although this is frequently not appreciated or understood.

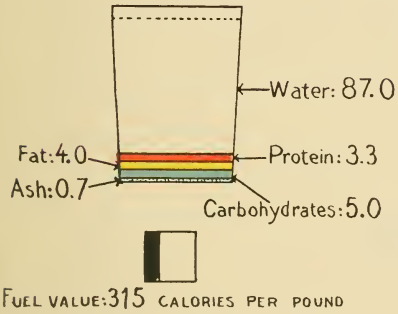
Buttermilk closely resembles skim milk. Some of the lactose has undergone lactic fermentation and lactic acid bacilli and lactic acid are present. On account of these latter, buttermilk is believed to have a special medicinal food value.

Cream, as a food, resembles whole milk, except that on account of its high percentage of fat it has a fuel value nearly three times as large.

COMPOSITION OF FOOD MATERIALS.

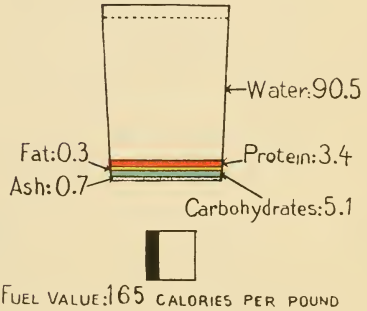


WHOLE MILK



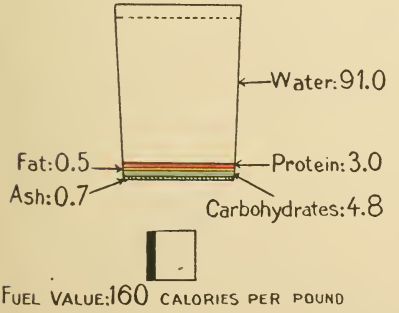
FUEL VALUE: 315 CALORIES PER POUND

SKIM MILK



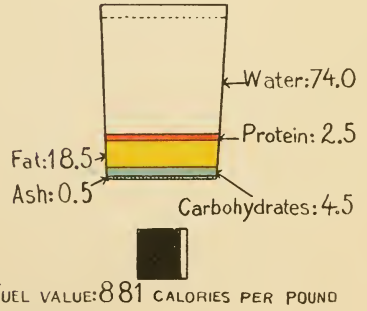
FUEL VALUE: 165 CALORIES PER POUND

BUTTERMILK



FUEL VALUE: 160 CALORIES PER POUND

CREAM



FUEL VALUE: 881 CALORIES PER POUND

Chart 1 — Milk and Milk Products

Eggs and Cheese

Eggs, in spite of their high percentage of water, are a rich food, i. e., they have a high fuel value due to the fat contained in the yolks. Their protein content is about eight-tenths as much as that found in meat. The fat of eggs contains the growth essential "fat soluble A" mentioned under milk. Eggs contain desirable mineral matter.

Cream Cheese is made from whole milk. The name "cream cheese" is somewhat misleading, since cheese is never made from cream alone. On account of a high fat content, cheese has a considerable food value and is a rich food. The proteins of cheese contain the animo acids essential for growth, while the fat contains the "fat soluble A" substance. Both proteins and fats are, therefore, "complete" like those in milk.

Cottage Cheese is made from skim milk, but since it contains less water than the latter its fuel value is correspondingly higher.

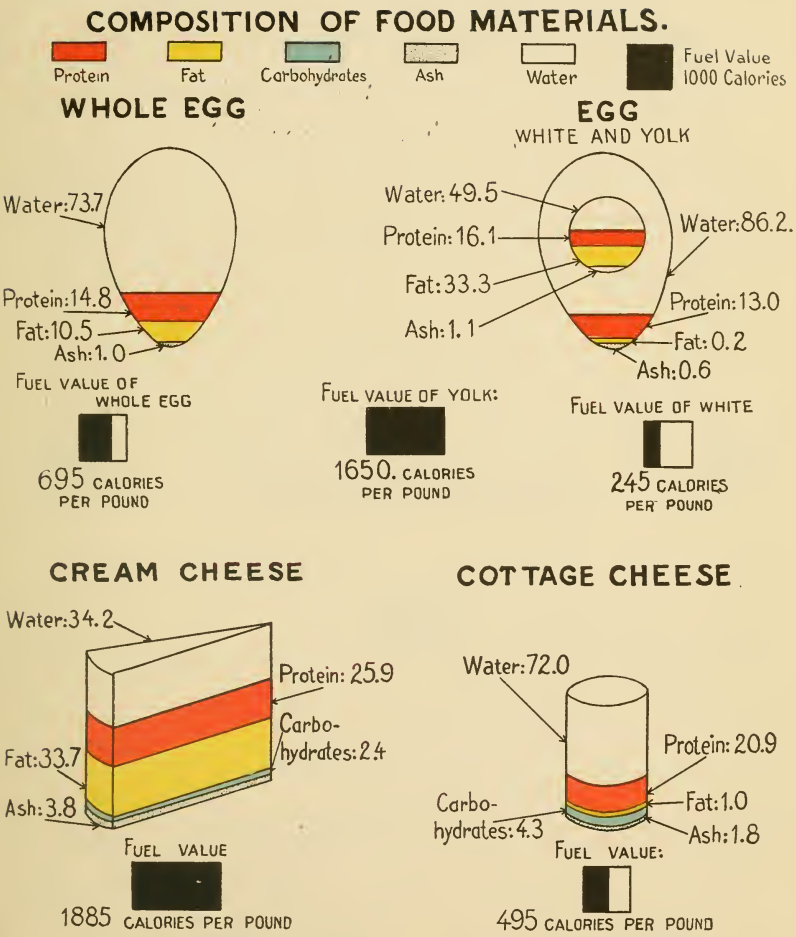


Chart 2 — Eggs and Cheese

Meat

Beef Steak, as represented on the chart, is perhaps the most common form of meat used in this country. The fact that it contains nearly sixty-two per cent of water must be a surprise to most people. One is accustomed to think of meat as a protein food, but the protein percentage is only 18.6. Many foods contain as much, or more, protein. But the great value of meat proteins lies in the fact that they are especially palatable and easily digested. Associated with these proteins there are "extractives," or flavoring substances, which also add greatly to the palatability of meats. On account of these extractives, meats are used for flavoring other foods. Meats contain some "complete proteins" and "fat soluble A," but not as much as eggs or milk products. The fuel value of beef-steak is a little less than that of bread.

The other meats shown on the chart have a higher fuel value because the percentage of water in them is less, especially in smoked ham.

Physiologically, or nutritionally, no appreciable difference is known to exist among the various kinds of meat. The difference in flavor, however, is an important factor, because, everything else being equal, the more palatable a food is, the more digestible it will be. The popular belief of a considerable difference between light and dark meats seems to have no foundation in fact.

COMPOSITION OF FOOD MATERIALS.

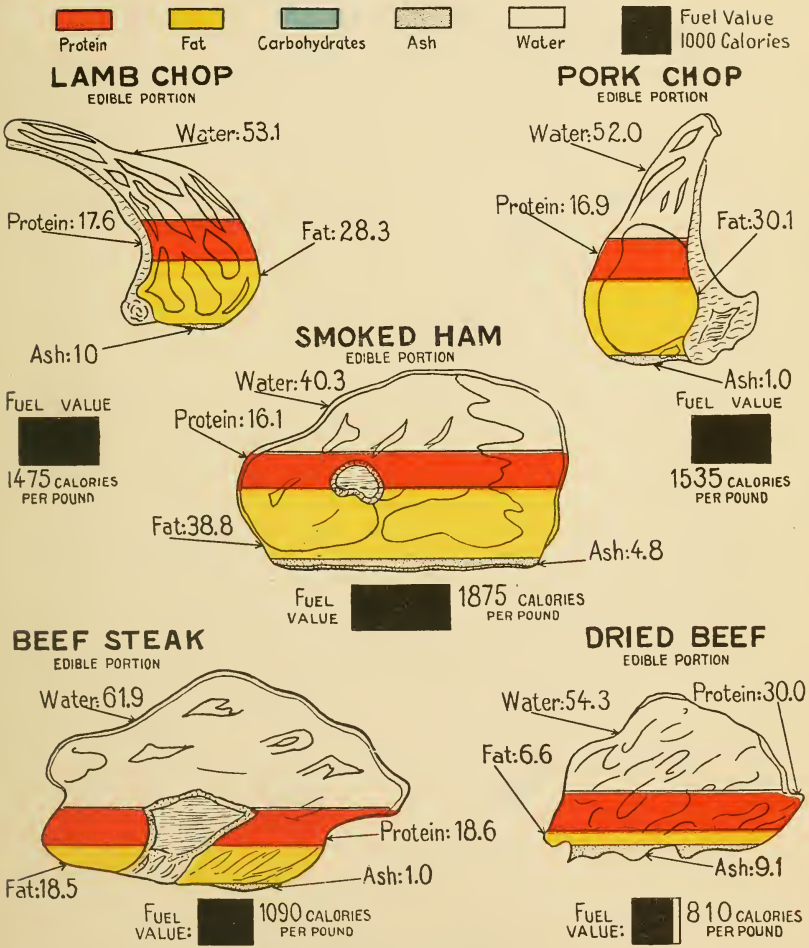


Chart 3 — Meat

Fish and Oysters

Fish belongs to the meat foods. Chemically and physiologically, fish is practically meat. The percentage of water is higher than in any other protein or meat food; the protein percentage is about the same as that in meat. Fish is classified as lean and fat. Whitefish and cod are examples of the lean class, while mackerel and salmon represent a fat fish. The fuel value of a lean fish is about one-fourth as great as meat, while a fat fish has a value of about one-half that of meat. Fish contains less extractives than meat and is about as digestible as the latter. Fat fish and fish products, such as salted, smoked and pickeled, are more difficult to digest than when fresh.

Oysters contain about the same percentage of water as milk, but only about one-third as much fat. On this account oysters are a very dilute food, even more so than milk. Their food value is quite low, and they are eaten more as a relish than as a food. They are one of the few animal foods containing a carbohydrate, namely, glycogen, sometimes called animal starch or muscle sugar. Oysters are easily digested, and almost universally used. Their popularity is no doubt due to the fact that they can be eaten raw, or prepared in so many different ways. Enormous quantities are used and the natural supply is supplemented by "oyster farming." Oysters are usually three years old before they are marketed. They are grown in salt water, and before marketing they are usually "floated," or fattened, in fresh water. During this process they absorb considerable water but lose some of their original flavor. If the floating has been done in contaminated water, oysters, especially if eaten raw, may be the means of transmitting typhoid fever.

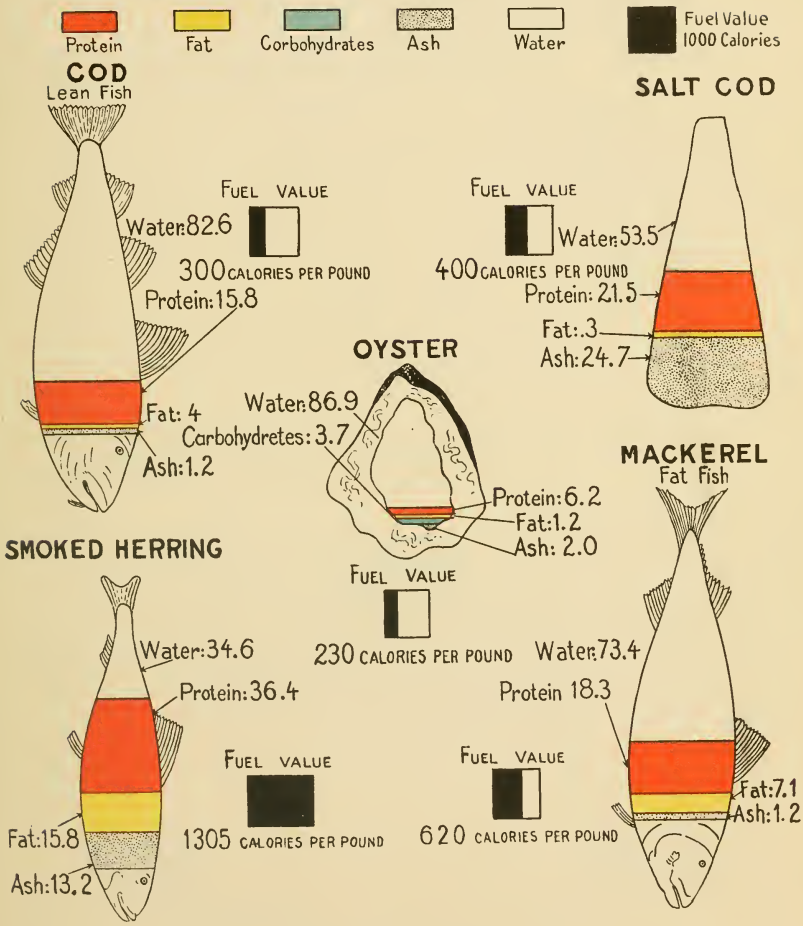


Chart 4 — Fish and Oysters

Fat Foods

Butter is the most important fat food on this chart. It is a milk product and, like milk, contains "fat soluble A," of course in a much larger amount. The amount of fat in butter should not be less than 82½ per cent. The percentage of water should not exceed sixteen per cent. Butter fat is one of the most palatable and most easily and completely digestible fats; it contains the growth essentials and a diet should always include milk or some milk product. Since butter substitutes hardly ever contain growth essentials, they are substitutes only in that they have approximately the same fuel value. Butter is a rich food, its fuel value being three times that of meat, or of bread, and nearly five times that of eggs. The ash or mineral matter in butter consists largely of added salt.

Olive Oil is all fat and has a higher fuel value than any other food except lard which furnishes the same number of calories. It is about as digestible as butter fat, but does not contain the growth essentials found in the latter.

Lard is the fat obtained from the hog and differs from olive oil mainly in flavor, otherwise these two fat foods are quite similar. Contrary to popular belief, lard is nearly as digestible as butter, and the difference is probably not noticeable to the ordinary digestive tract. It lacks the growth essentials of butter.

Bacon, the fat food obtained from the hog, is usually classed as a meat. It contains about one-half as much protein but nearly four times as much fat as beef-steak. This high percentage of fat gives to bacon a fuel value of nearly three times that of beef-steak.

Beef suet represents internal fat tissues of beef cattle. When heated the fat is melted out and is then called tallow. Like the other fat foods, its fuel value is high, but it is not so easily digested as butter fat, nor does it contain the growth essentials of the latter.

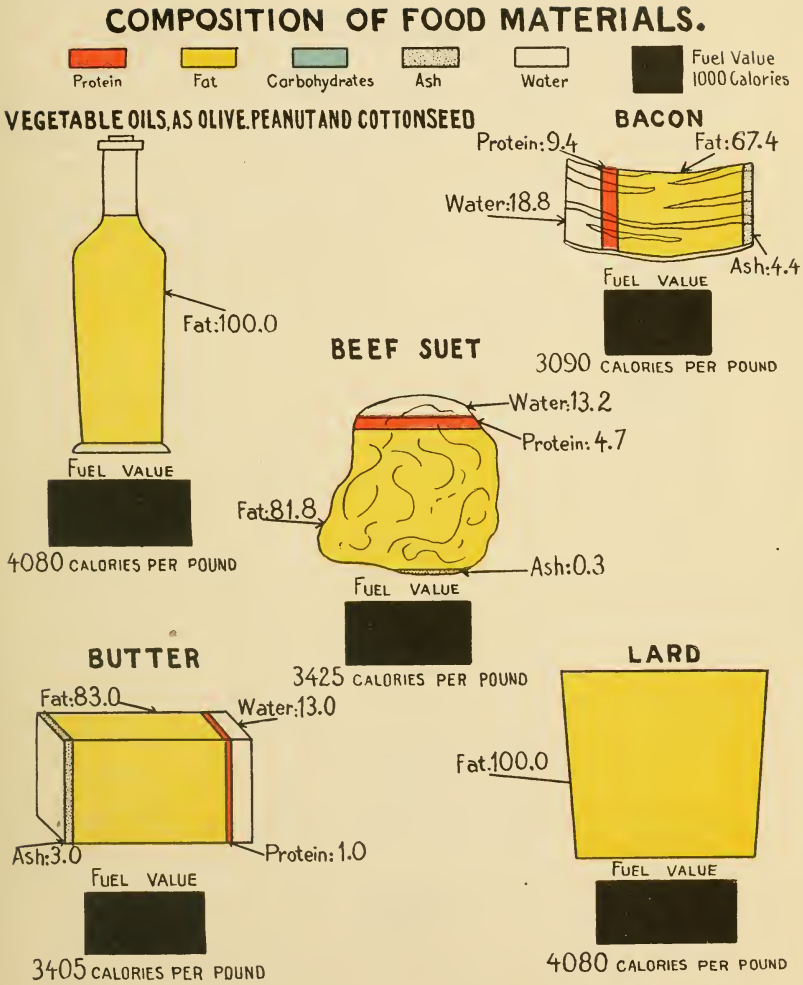


Chart 5 — Fat Foods

Cereal Grains

Wheat is the most important food grain in this as well as in many other countries. It is usually classed as a carbohydrate food, but it also contains considerable protein, about two-thirds as much as found in meat. Whole wheat contains nutritionally valuable mineral matter as well as vitamins, and whole wheat preparations are excellent foods. The proteins of wheat are not as complete physiologically as those of meat, nor do they have the stimulating flavor of the latter. Measured in calories, wheat has nearly the same nutritional value as cheese, about one and one-half times that of meat and nearly five times that of milk.

Corn is the next most important food grain. It differs from wheat principally in its greater fat and lesser protein content and a slightly higher food value. Cornmeal and corn flour will no doubt be the important wheat substitutes of the future. Corn products are especially deficient in the amino acids necessary for tissue development.

Rice is sometimes called the grain that feeds one-third of the world. It contains about one-third less protein, but somewhat more starch than wheat. It has a good flavor, is readily digested, and when "unpolished" contains growth essentials (vitamins). Polished rice should not be used as a food unless in a mixed diet.

Oats contain more fat and mineral matter than the other grains. Its nutritive value is about the same as wheat. There is no special reason why it should not be eaten in summer as well as in winter. The first cereal breakfast food was made from oats. Wheat, corn, rye and rice are now also used extensively for that purpose.

Rye is the food staple of Russia and Germany. In the United States rye is almost neglected as a food. Its composition is almost identical with wheat, but on account of its dark color, and lack of gluten, a rye loaf does not appear as palatable as wheat bread.

Buckwheat is not a cereal botanically, but is usually classed with the cereal foods. Comparatively small quantities of buckwheat are used, mostly in the form of flour which is dark and used for pancakes.

Whole-Wheat Bread is incorrectly named, since it is very rarely made from whole wheat flour. What is ordinarily called whole wheat flour does not contain all the original wheat kernel, but is partly refined by bolting. Bread made from such flour has a slightly lower food value, but contains more protein and mineral matter than ordinary white bread. It belongs to a class of foods which are not over-refined. Ordinary white flour is an over-refined food, and alone would not be a complete food.

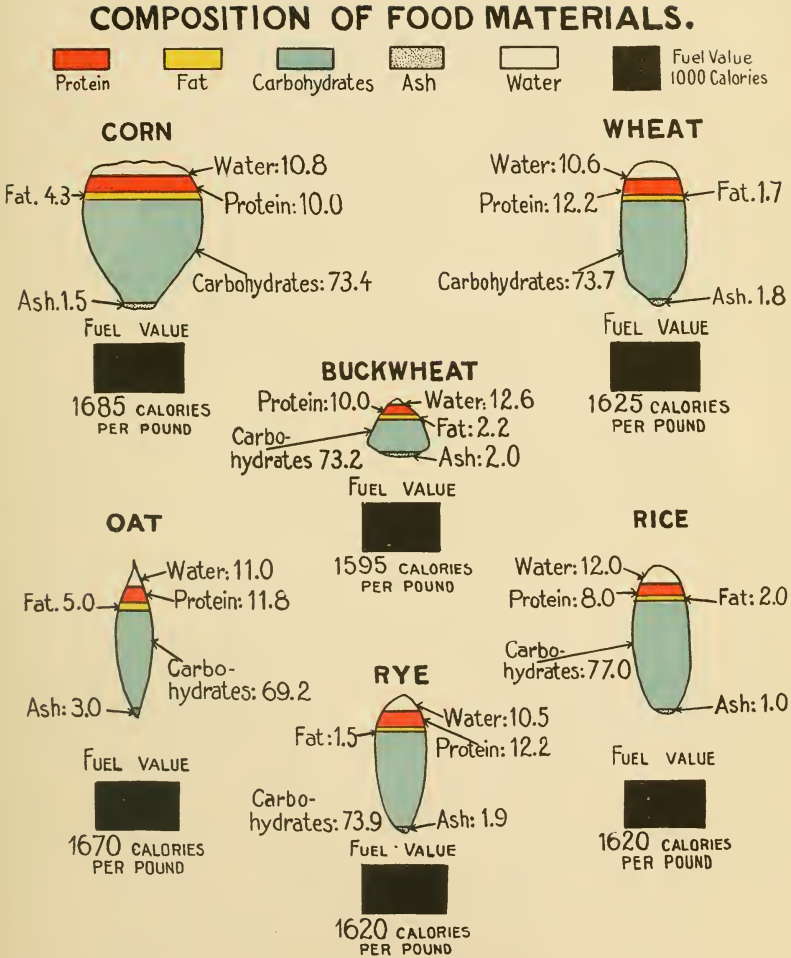


Chart 6 — Cereal Grains

Bread and Other Cereal Foods

Bread—By this term, as ordinarily used, is meant wheat bread made from the so-called "patent" or "baker's" flour. These flours do not represent the entire wheat kernel; much that is nutritionally valuable has been removed with the bran and by bolting. Bread contains more water than most people suspect and the percentage of protein is one-half that of meat. Its nutritive value is four times that of milk, nearly twice that of eggs and a little more than that of meat. It is usually considered a carbohydrate food, and is cheap.

Toasted bread differs from ordinary bread in a lower percentage of water and a correspondingly higher percentage of the other components and fuel value.

Corn bread, as shown in the chart, is made from refined cornmeal, i. e., ground whole corn from which the outer coating and most of the germ with its protein and fat have been removed. Its food value is about the same as bread.

Oatmeal breakfast food has a low food value if cooked and contains 84½ per cent. of water.

Macaroni when cooked is made from wheat flour containing a high percentage of protein. Like all other cooked cereal foods, it has a high percentage of water and a low food value.

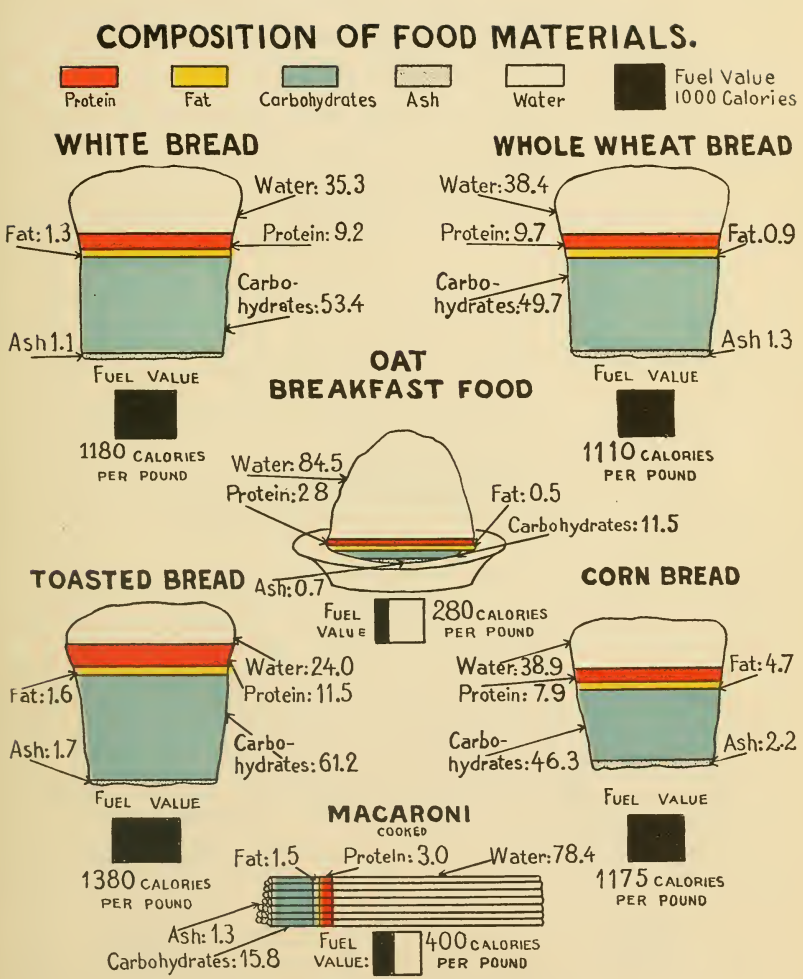


Chart 7 — Bread and Other Cereal Foods

Sugar and Similar Foods

Sugar—Cane and beet sugar are chemically and physiologically identical. Some people claim they can tell the difference; chemists cannot. Sugar is a refined food and therefore lacks growth essentials. It is considered a rich food, its fuel value being one and one-half times that of bread. Sugar is all carbohydrate.

Molasses is the by-product of sugar making. It is a carbohydrate food and contains a mixture of cane and invert sugars. It also contains mineral matter and other substances originally present in the cane juice from which it was made.

Candy, as shown, is the stick or hard variety and represents the purest kind. It is a rich food, but not much used in the stick form. There are, however, many other forms of candy and enormous quantities are manufactured and eaten. The art of candy making, together with our national taste for all kinds of sweetmeats, is highly developed. The fuel value of most candies is high, depending on what and how much is mixed with the sugar used in making them.

Maple sugar is chemically identical with cane sugar, but as found in the market contains water, mineral matter and flavoring substances. Maple sugar and syrup owe their popularity and palatability to these flavoring substances obtained from the maple tree.

Honey is usually erroneously defined as the nectar secreted by flowers and gathered by bees. The bee does more than to gather it. By means of its long tongue the nectar is sucked out of the flowers and swallowed into the honey sack of the bee. Here the nectar, which consists of about thirty per cent. of sugar and about seventy per cent. of water, undergoes chemical changes not well understood. The sugar is changed into invert sugar, and small quantities of gums and volatile substances, some of them originally present in the nectar and others developed by the bee, impart to honey its flavor. The carbohydrates of honey are mainly a mixture of dextrose and levulose—a natural invert sugar.

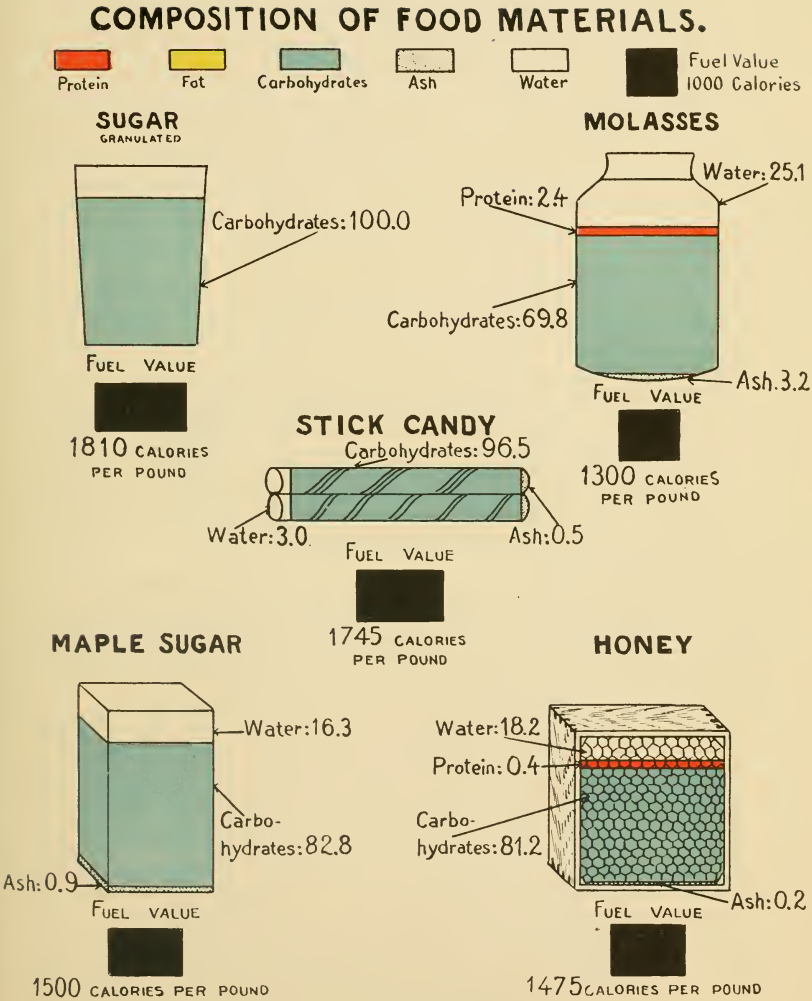


Chart 8 — Sugar and Similar Foods

Vegetables

Potatoes—Most noticeable about potatoes is their high percentage of water and low food value. They are not a rich food and for that reason can be, and usually are, eaten in comparatively large quantities. They contain valuable mineral matter and are usually classed as a carbohydrate food. A diet which consists largely of potatoes is one sided, and should be supplemented with protein and fat foods. Potatoes can be grown almost anywhere and have an agreeable taste when prepared in any one of dozens of ways, which accounts for their popularity as a food.

Onions, although they have quite an appreciable food value, are eaten usually as a relish and used for flavoring. Because of their odor and flavor they are believed by many people to possess medicinal properties. Hence the saying, "An onion a day will keep the doctor away." Chemists and dietitians have been unable so far to discover in onions any therapeutic value other than that of vegetables in general as part of a well balanced diet. Vegetables usually supply valuable mineral matter and vitamins.

Parsnips contain nearly as much starch as potatoes, but on account of their flavor they are not as popular as the latter. Like many other vegetables, parsnips contain valuable mineral matter, especially potassium and phosphates.

Celery is eaten as a relish, not as a food. It is often stated that celery is a brain food, but why it should be called such nobody seems to know. Nothing has been discovered in celery which could be classed as a special brain food, and it probably possesses only the usual vegetable values.

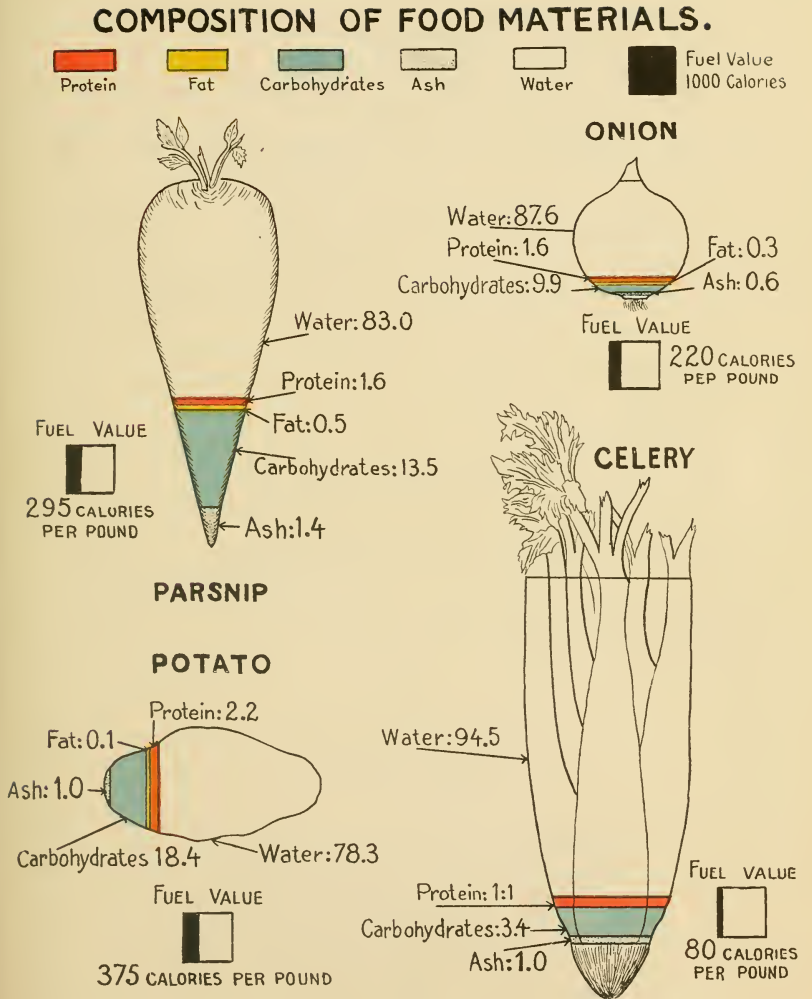


Chart 9 — Vegetables

Beans and Corn

Beans—Of the foods shown in this chart, dry beans are the most important. Cooked and canned, either alone or with pork, tomatoes, etc., they are a popular American ready-to-serve food. Baked beans are an important item in our dietary. They are a "mixed" food, containing considerable carbohydrates, proteins and mineral matter. They contain more carbohydrates than bread and more than twice as much protein. Meat has less protein than beans, but the latter, although sometimes called the poor man's meat, should never be wholly substituted for meat. The proteins of beans are not dietetically complete and do not have the agreeable flavor of meat proteins. The difficulty in digesting beans, resulting in the gas formation which some people experience, is believed to be due to the peculiar character of the carbohydrates. The composition of *peas* is almost identical with beans and most of what has been said about the latter applies to peas also. Beans and peas are rich foods.

Fresh beans, as shown in the chart, contain more water and less of the other components than the dry beans. Green string-beans are mostly water and resemble the so-called green vegetables.

Green corn, or corn on the cob, although three-fourths water, has considerable food value on account of its starch content. It is both a relish and a food, and is classed with the so-called green vegetables. Green or succulent vegetables are valuable because they usually contain necessary mineral matter, vitamins, and supply the purest kind of water for our digestive processes.

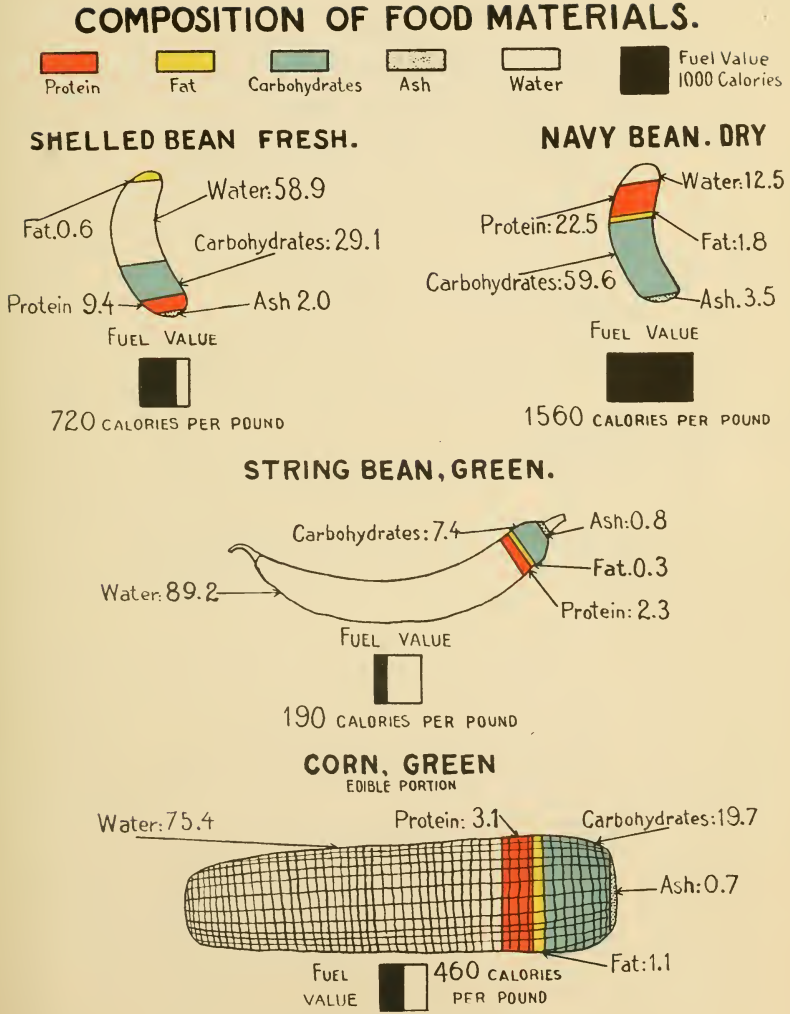


Chart 10 — Beans and Corn

Fruit

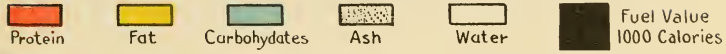
Apples are undoubtedly the most popular fruit in America. Their fuel value, which is due principally to carbohydrates, is quite low, and they are not a rich food. Like other fruits, although no medicinal substances have been found in apples, they are of special value in the diet on account of vitamins, mineral substances, and their agreeable flavor, which act as a stimulant to digestion. Their popularity is due principally to the pleasant flavor, or variety of flavors, in the different kinds of apples and also to the fact that they can be eaten raw or prepared in an almost endless number of ways and combinations. They can be grown almost anywhere in America.

Bananas are one of the richest of the fresh foods, and consist principally of carbohydrates and water. Like apples, they have an agreeable flavor and ordinarily they are a cheap fruit. They would be more popular and cheaper if they could be more extensively raised in this country. Bananas, when eaten raw, no doubt supply growth essentials.

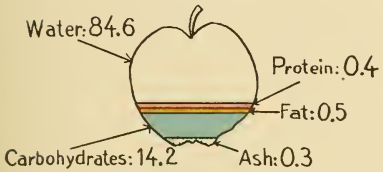
Figs are a rich food, richer than bread or meat, and about the same as beans. Their food value is due mainly to carbohydrates (mostly sugar). They are supposed to possess special therapeutic qualities, but, so far, no medicinal components have been found in them.

Strawberries have very little food value. They are eaten as a relish and play no important part in our dietary as a food.

COMPOSITION OF FOOD MATERIALS.

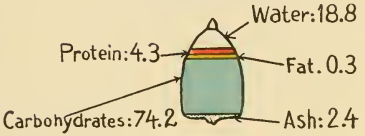


APPLE
EDIBLE PORTION



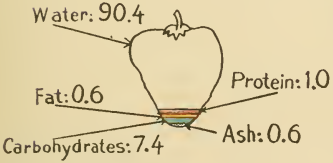
FUEL VALUE  285 CALORIES PER POUND

DRIED FIG
EDIBLE PORTION



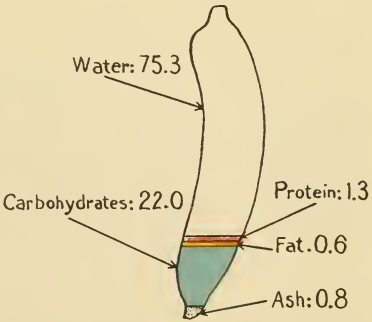
FUEL VALUE  1435 CALORIES PER POUND

STRAWBERRY
EDIBLE PORTION



FUEL VALUE  175 CALORIES PER POUND

BANANA
EDIBLE PORTION



FUEL VALUE  445 CALORIES PER POUND

Chart 11 — Fruit

Fruit—Continued

Grapes have a greater food value and are nearly as popular as apples. Their carbohydrate content and their flavor make them both a food and a relish. Unfortunately, they are much more perishable than apples.

Raisins are dried grapes. They are concentrated food and in fuel value rank with dried figs and beans.

Canned fruit contains considerable water and is, therefore, not a rich food. Its food value is due to fruit sugar and the sugar added in canning. It is consumed in enormous quantities, ordinarily as a relish.

Fruit jelly on account of its high sugar content is a rich food. It is popularly considered a relish and when used as such only small amounts should be eaten.

Grape-juice has no appreciable food value. It is used as a relish on account of its flavor.

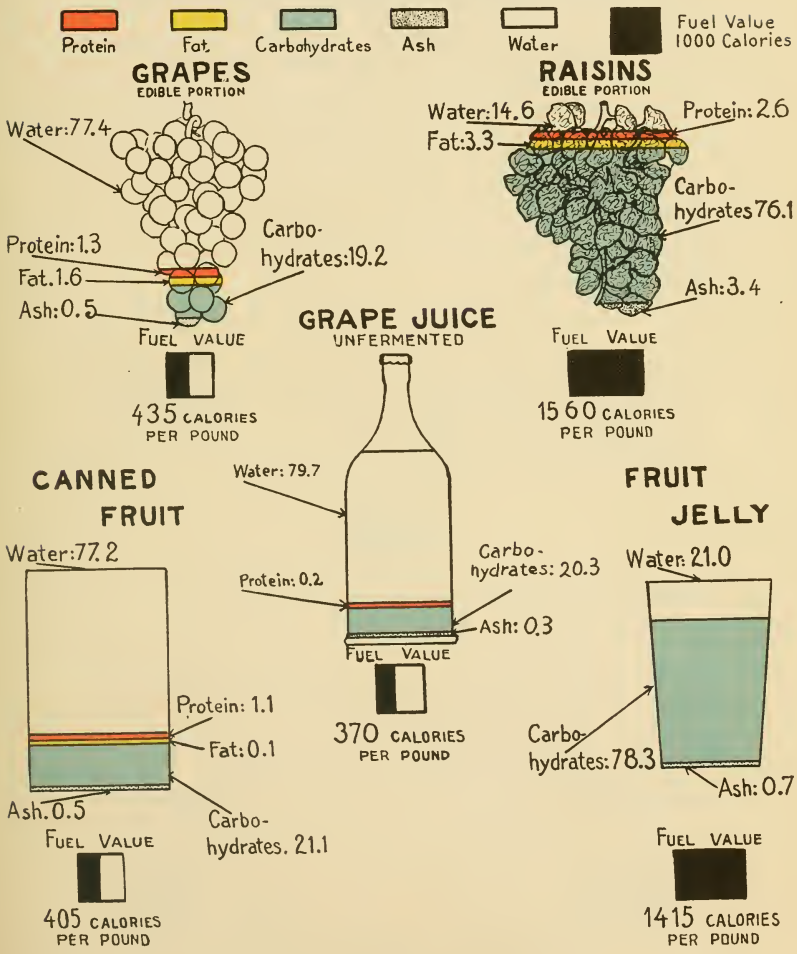


Chart 12 — **Fruit** (Continued)

Nuts

Peanuts—The composition and food value of peanuts are probably a surprise to most people. Peanuts are among the richest and cheapest of our foods, although generally not considered a food. They contain considerable more protein than does meat. They resemble cheese in their high fat and protein content, while their carbohydrate percentage is considerably higher. Of the vegetable proteins, those contained in peanuts are among the most complete.

Peanut butter, as shown in the chart, contains less water and more fat than peanuts and, therefore, possesses a higher food value. When peanut butter is made by simply grinding peanuts it has the same food value as the latter.

Walnut kernels contain a considerable amount of the three components, especially fat. Their high food value is due to the presence of the latter. Like all other rich foods, walnuts should be eaten sparingly, otherwise they might cause digestive disturbances—which frequently lead people to believe that such foods are hard to digest.

Chestnuts are a starchy food.

Cocoanut, dried, sometimes called shredded cocoanut, is a rich food, mainly on account of its high fat content.

Charts 14 and 15 are self-explanatory.

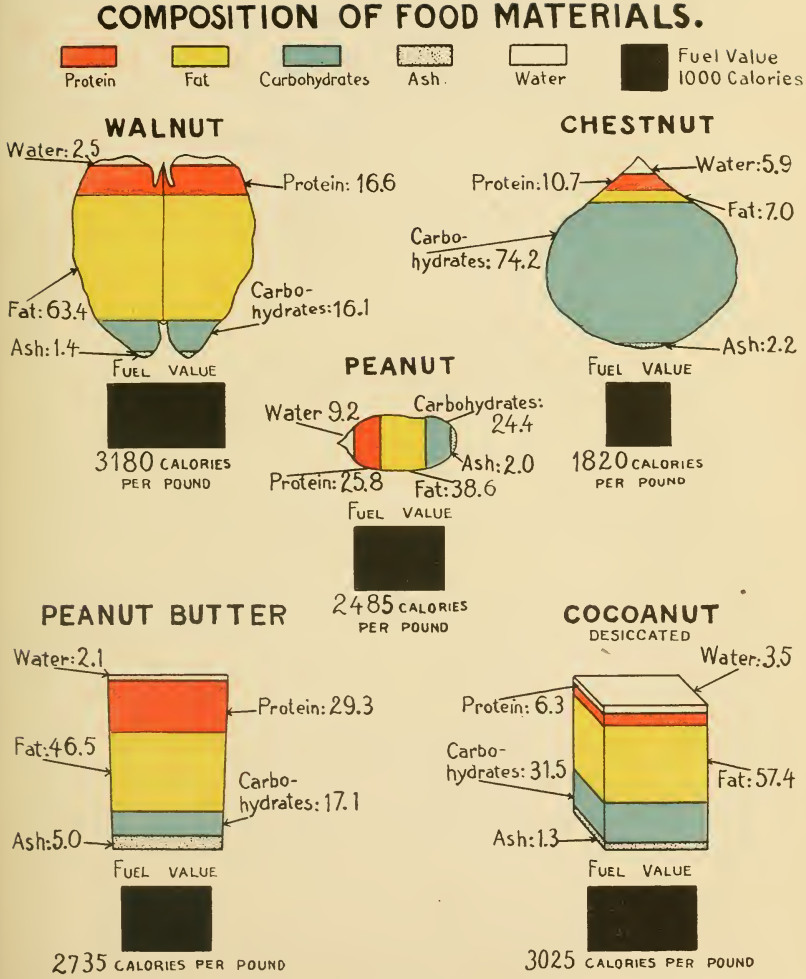


Chart 13 — Nuts

FUNCTIONS AND USES OF FOOD.

CONSTITUENTS OF FOOD.

FOOD AS PURCHASED CONTAINS
- EDIBLE PORTION — Flesh of meat, yolk and white of eggs, wheat flour, etc.
  - Water
  - Nutrients
    - Protein
    - Fats
    - Carbohydrates
    - Mineral Matter Or Ash
- REFUSE — Bones, entrails, shells, bran, etc.

USE OF FOOD IN THE BODY.

PROTEIN---------- Builds and repairs tissue
White (albumen) of eggs, curd (casein) of milk, lean meat, gluten of wheat, etc.

FATS---------- Are stored as fat
Fat of meat, butter, olive oil, oils of corn and wheat, etc

CARBOHYDRATES---- Are transformed into fat
Sugar, starch, etc.

All serve as fuel to yield energy in the forms of heat and muscular power.

MINERAL MATTER OR ASH--- Share in forming bone, assists in digestion, etc.
Phosphates of lime, potash, soda, etc.

Food is that which, taken into the body, builds tissue or yields energy.

DIETARY STANDARDS.

DIETARY STANDARD FOR MAN IN FULL VIGOR AT MODERATE MUSCULAR WORK.

Condition considered	Protein	Energy
	Grams	Calories
Food as purchased	115	3,800
Food eaten	100	3,500
Food digested	95	3,200

ESTIMATED AMOUNT OF MINERAL MATTER REQUIRED PER MAN PER DAY.

	Grams		Grams
Phosphoric acid (P_2O_5)	3 to 4	Calcium oxid	0.7 to 1.0
Sulphuric acid (SO_3)	2 to 3.5	Magnesium oxid	0.3 to 0.5
Potassium oxid	2 to 3	Iron	0.006 to 0.012
Sodium oxid	4 to 6	Chlorin	6 to 8

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DEPARTMENT OF PHARMACY, Bulletin (quarterly).

DEPARTMENT OF LAW, Annual Announcement and Register.

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